In the United States Court of Federal Claims

OFFICE OF SPECIAL MASTERS

Filed: July 31, 2019

* * * * * * * * * * * * * * * * * * *		
STEVEN PEARSON,	*	PUBLISHED
	*	
Petitioner,	*	No. 16-9V
	*	
v.	*	Chief Special Master Dorsey
	*	
SECRETARY OF HEALTH AND HUMAN SERVICES,	*	Dismissal Decision; Influenza (Flu) Vaccine; Transverse Myelitis; Onset.
	*	
Respondent.	*	
	*	
* * * * * * * * * * * * * * * * * * *		

Randall G. Knutson, Knutson & Casey Law Firm, Mankato, MN, for petitioner.
Lisa A. Watts, U.S. Department of Justice, Washington, DC, for respondent.

DECISION[1]

I. INTRODUCTION

On January 4, 2016, Steven E. Pearson ("petitioner") filed a petition under the National Vaccine Injury Compensation Program ("Vaccine Act" or "the Program"),[2] 42 U.S.C. § 300aa-10 et seq. (2012) alleging that as a result of receiving an influenza ("flu") vaccine on October 18, 2012, he suffered from transverse myelitis ("TM"). Petition at 1-2. Respondent argued against compensation, stating that "the record fails to establish a more likely than not causal connection between petitioner's flu vaccination and his subsequent condition." Respondent's Report

[1] Because this Decision contains a reasoned explanation for the action in this case, the undersigned is required to post it on the United States Court of Federal Claims' website in accordance with the E-Government Act of 2002. 44 U.S.C. § 3501 note (2012) (Federal Management and Promotion of Electronic Government Services). **This means the Decision will be available to anyone with access to the Internet.** In accordance with Vaccine Rule 18(b), petitioner has 14 days to identify and move to redact medical or other information, the disclosure of which would constitute an unwarranted invasion of privacy. If, upon review, the undersigned agrees that the identified material fits within this definition, the undersigned will redact such material from public access.

[2] The National Vaccine Injury Compensation Program is set forth in Part 2 of the National Childhood Vaccine Injury Act of 1986, Pub. L. No. 99-660, 100 Stat. 3755, codified as amended, 42 U.S.C. §§ 300aa-10 to -34 (2012). All citations in this decision to individual sections of the Vaccine Act are to 42 U.S.C. § 300aa.

("Resp. Rept.") at 10 (ECF No. 17). Respondent also contended that "as an initial matter, the diagnosis . . . is unclear," and that petitioner "has failed to establish that the onset of his symptoms, approximately eleven weeks after vaccination, occurred within a medically acceptable time frame for a causal association." Id.

After carefully analyzing and weighing the evidence presented in this case in accordance with the applicable legal standards, the undersigned finds that petitioner has failed to provide preponderant evidence that the flu vaccine he received on October 18, 2012, caused his TM. Therefore, this case must be dismissed.

II. PROCEDURAL HISTORY

The petition was filed in this matter on January 4, 2016,[3] along with petitioner's medical records and affidavit. Petitioner's Exhibits ("Pet. Exs.") 1-7 (ECF No. 1). Petitioner filed additional medical records on April 22, 2016, and a Statement of Completion on May 18, 2016. Pet. Exs. 8-13 (ECF No. 11); Pet. Statement dated May 18, 2016 (ECF No. 12). On September 12, 2016, respondent filed his Rule 4(c) Report, recommending against compensation. Resp. Rpt. at 2.

On October 27, 2016, the undersigned advised the parties during a Rule 5 status conference that litigative risk assessment was appropriate and encouraged them to pursue informal resolution. Order dated Oct. 27, 2016 (ECF No. 19). On December 5, 2016, respondent indicated that the parties had reached a tentative settlement. 15-Week Stipulation Order dated Dec. 6, 2016 (ECF No. 22). However, on February 24, 2017, respondent informed the undersigned that the authorized representative of the Attorney General had declined to grant settlement authority for the proposed settlement. Resp. Status Rept. dated Feb. 24, 2017 (ECF No. 23).

A status conference was held in March 2017 to determine next steps in the case, and the parties agreed that petitioner should file an expert report. Order dated Mar. 9, 2017 (ECF No. 24). On May 9, 2017, petitioner filed additional medical records and an expert report by Dr. James Dahlgren, MD. Pet. Exs. 14-16 (ECF No. 25). On August 3, 2017, respondent filed a responsive expert report by Dr. Timothy Vartanian, M.D., Ph.D. Resp. Exs. A-B (ECF No. 31).

On September 25, 2017, the undersigned ordered petitioner to file an affidavit regarding the onset of his transverse myelitis, a supplemental expert report, and a motion for a ruling on the record or status report. Order dated Sept. 25, 2017 (ECF No. 32). Petitioner filed his affidavit on October 11, 2017, a supplemental expert report by Dr. Dahlgren on November 13, 2017, and a motion for a ruling on the record on November 14, 2017. Pet. Affidavit ("Aff.") dated Oct. 11, 2017 (ECF No. 33); Pet. Ex. 17 (ECF No. 34); Pet. Motion ("Mot.") dated Nov. 14, 2017 (ECF

[3] Based on the onset date alleged in the petition, petitioner would have been required to file his claim by December 31, 2015, in order to comply with the statute of limitations. See § 16(a)(2). However, as respondent noted, the U.S. Court of Federal Claims was closed on December 31, 2015; this petition was filed on January 4, 2016, the date the Court reopened. Resp. Rept. at 2 n.2; see also Vaccine Rule 19(a)(1)(c).

No. 35). On November 27, 2017, respondent filed a motion requesting the opportunity to have Dr. Vartanian respond to the four points raised in the undersigned's September 25, 2017 Order, in light of Dr. Dahlgren's submission. Resp. Mot. dated Nov. 27, 2017 (ECF No. 36). The motion was granted, and respondent filed a responsive report by Dr. Vartanian on January 19, 2018. Order dated Nov. 27, 2017 (ECF No. 37); Resp. Ex. C (ECF No. 39).

Petitioner subsequently filed updated neurology records on May 17, 2018, and an expert report from his treating neurologist, Dr. Scott Lipson, M.D., on May 25, 2018. Pet. Ex. 18 (ECF No. 46); Pet. Exs. 19-20 (ECF No. 47). On August 9, 2018, respondent filed a second supplemental report by Dr. Vartanian, and on September 6, 2018, petitioner submitted a final supplemental report from Dr. Lipson. Resp. Ex. D (ECF No. 51); Pet. Ex. 21 (ECF No. 52).

On November 1, 2018, the undersigned held a status conference and explained to the parties that after reviewing the supplemental expert reports from Dr. Lipson and Dr. Vartanian, she had preliminarily determined that petitioner was not entitled to compensation. Order dated Nov. 2, 2018 (ECF No. 54). The undersigned suggested that petitioner file a renewed motion for a ruling on the record, which petitioner filed later that day. Id.; Pet. Mot. dated Nov. 1, 2018 (ECF No. 53). Respondent filed his response to petitioner's motion for a ruling on the record on November 30, 2018. Resp. Response dated Nov. 30, 2018 (ECF No. 55).

This matter is now ripe for adjudication.

III. FACTUAL SUMMARY

A. Medical History Prior to Vaccination

Mr. Pearson was born on December 31, 1953. Pet. Ex. 1. His medical history is significant for hearing loss, vertigo, right hip pain, depression, and anxiety. Pet. Ex. 8 at 5. In the three years preceding the vaccination at issue, he received medical care from his primary care physician, Dr. David E. Dennis. Petitioner saw Dr. Dennis several times in 2009 for upper respiratory infection with bronchitis, infected nasal septum, tinnitus due to cerumen impaction, dizziness, elevated blood pressure, and depression. Pet. Ex. 8 at 3-6.

In 2010 through 2012, petitioner saw Dr. Dennis for various complaints. In 2010, petitioner experienced dizzy spells thought to be due to anxiety, excessive alcohol use, or Meniere's Disease. Pet. Ex. 8 at 8-9, 21. Petitioner also complained of right lower back pain and was diagnosed with lumbar sprain and right sacroiliitis. Id. at 22-28; Pet. Ex. 9 at 134. Lumbar spine X-rays showed degenerative changes, especially at L4-5. Pet. Ex. 8 at 23. In 2011 and 2012, petitioner had left knee pain that resolved with medication and time. Id. at 32-35, 38. In 2012, petitioner had an upper respiratory tract infection, situational anxiety, depression, a fungal infection in his feet, and cerumen impaction of his ears. Id. at 37, 39-40. He also reported a history of blurred vision in his right eye.[4] Id. at 41.

[4] Another physician was treating petitioner for this ailment, but Dr. Dennis commented that petitioner was "simply going to have to live with this blurriness." Pet. Ex. 8 at 41.

B. Date of Vaccination

Petitioner received the flu vaccination at issue on October 18, 2012. Pet. Ex. 8 at 1. Of note, he also received seasonal flu vaccinations on October 19, 2011; September 26, 2013; and November 6, 2014. Id. Aside from petitioner's allegations related to the flu vaccine administered on October 18, 2012, no documentation in the medical records indicates that petitioner had any adverse reaction to his other flu vaccinations.

C. Subsequent Clinical Course

On November 8, 2012, petitioner saw Dr. Dennis for a "health maintenance examination." Pet. Ex. 8 at 41. Petitioner reported that he consumed four beers every day and experienced stress due to family issues. Id. There was no indication at this visit that petitioner had any adverse reaction to his flu vaccine the previous month.

Petitioner next saw Dr. Dennis on January 4, 2013. He complained of "pain of the left chest going down the left arm" with painful skin, sensitive to touch. Pet. Ex. 8 at 47. Dr. Dennis did not document how long these symptoms had been present. Physical examination revealed scratching of the skin on the left side, with "exquisitely painful pressure points on [his] back and down [his] left arm." Id. Dr. Dennis diagnosed petitioner with herpes zoster (shingles) "prior to the eruption of vesicles." Id.

Petitioner returned to Dr. Dennis on January 28, 2013, still complaining of pain in his left arm. Pet. Ex. 8 at 50. Dr. Dennis noted that petitioner "never did develop vesicles, so we are not entirely sure that he ever had shingles, though we treated him for the same due to the radicular nature of this pain." Id. In addition to symptoms in the left arm, petitioner also complained of "tingling and itching of the left leg and left abdomen." Id. Petitioner had a "little follicular rash of the left shoulder," but no other rash. Id. Dr. Dennis diagnosed petitioner with pruritis with no "particular etiology" and "[v]ague chest pain and pressure with left arm discomfort." Id. Cardiac studies were ordered, which showed normal heart function with no evidence of cardiac ischemia. Id. at 54-56.

On March 21, 2013, petitioner saw Dr. Keith Hansen for lower back pain after slipping on ice. Pet. Ex. 8 at 57. He was diagnosed with left sacroiliac strain and treated with a Medrol Dosepak. Id. On May 30, 2013, petitioner again presented to Dr. Dennis's office with "herpetic neuralgia pain left chest and arm," which had worsened over the last few days. Id. at 60. Dr. Dennis noted that petitioner's "herpetic infection was quite some time ago." Id. Dr. Dennis diagnosed petitioner with post-herpetic neuropathy and prescribed gabapentin. Id. Petitioner returned for follow-up on June 13, 2013, and reported that although the gabapentin helped, he continued to have "zingers that come through." Id. at 61. Dr. Dennis increased the dose of gabapentin. Id. At his return visit on July 3, 2013, petitioner reported that the medication was controlling his symptoms. Id. at 62. No documentation from the visits of January 2013 through March 2013 suggests that petitioner had leg weakness, gait problems, or urinary retention.

Petitioner did not return to Dr. Dennis for herpetic neuropathy symptoms until September 26, 2013, when he again complained of "left arm pain going down the inside of the left arm,"

which he attributed to shingles. Pet. Ex. 8 at 65. Dr. Dennis noted that petitioner previously only exhibited "one tiny lesion on the back" that may have been a zoster lesion. Id. At this point, Dr. Dennis decided to "totally reassess" the problem since petitioner never had the "classic blistery shingles rash." Id. Dr. Dennis ordered an MRI of the cervical spine. Id. Incidentally, petitioner also received a seasonal flu vaccine at this visit. Id. No documentation suggests that petitioner had any adverse reaction to this vaccination.

An MRI of the cervical spine was performed September 27, 2013. It showed a "T2 hyperintense focus in the lower cervical and upper thoracic [spinal] cord at the C7-T1 level." Pet. Ex. 8 at 76. No appreciable enhancement was noted. Id. Differential diagnoses included demyelinating conditions like multiple sclerosis ("MS") or "other forms of myelitis, including infection or idiopathic transverse myelitis." Id. After receiving the results of the MRI, Dr. Dennis ordered additional diagnostic tests including sedimentation rate, C-reactive protein, ANA, and Lyme titer, which were all normal. Id. at 68, 71, 80-81. A brain MRI showed no "evidence of acute intracranial abnormality." Pet. Ex. 9 at 87. Dr. Dennis referred petitioner to a neurologist, Dr. Alireza Yarahmadi, for consultation. Id. at 87-89.

Dr. Yarahmadi first saw petitioner on October 3, 2013. Dr. Yarahmadi noted that "[a]pproximately 10 months ago [petitioner] started noticing paresthesia and pain over his left chest and left shoulder." Pet. Ex. 9 at 88. Petitioner compared his pain to an"electric shock or stabbing feeling." Id. Physical examination revealed "decreased sensation in distribution of C6 and C7 dermatomes on the left side." Id. at 89. Impression was "[m]yelitis extending from left C7 to T1 for up to 5 cm . . . . Etiology is unknown." Id. Dr. Yarahmadi ordered additional diagnostic testing to "look for autoimmune/infectious causes." Id.

Petitioner returned for a follow-up appointment with Dr. Yarahmadi on October 17, 2013. The results of an NMO antibody test[5] were normal, as were the other laboratory tests. Pet. Ex. 13 at 16-17. Cerebrospinal fluid showed "slightly elevated ACE and protein," but also revealed normal oligoclonal bands[6] and IgG index. Id. Dr. Yarahmadi diagnosed petitioner with myelitis from left C4 to T1. Id. He concluded that the most likely causes were related to infection, autoimmunity, or malignancy. Id. He did not document vaccination as a possible cause.

Dr. Yarahmadi next saw petitioner on September 30, 2014. Petitioner reported residual paresthesia and pain in his left shoulder and arm. Pet. Ex. 13 at 23. Repeat thoracic MRI showed persistent abnormal findings at T1. Id. Dr. Yarahmadi documented that petitioner's workup was unremarkable for "autoimmune, metabolic, and infectious causes." Id. at 24. Petitioner was offered a second opinion but elected to "continue with conservative measures." Id.

[5] An NMO antibody test screens for the autoantibody NMO-IgG, also known as aquaporin-4, which assists doctors with early diagnosis of NMO. Neuromyelitis optica, Mayo Clinic, https://www.mayoclinic.org/diseases-conditions/neuromyelitis-optica/diagnosis-treatment/drc-20375655 (last visited June 11, 2019).

[6] Two oligoclonal bands in the CSF were noted on the lab report. Pet. Ex. 13 at 30.

In February 2015, petitioner had numbness, tingling, and weakness of his left leg, and he was diagnosed with radiculopathy. Pet. Ex. 11 at 316-17. Physical therapy was prescribed. Id. No reference was made to abnormal gait or urinary retention at that time. On August 27, 2015, petitioner was once again evaluated by Dr. Yarahmadi. A repeat MRI again showed myelitis extending from left C7 to T1. Pet. Ex. 13 at 27. A subsequent MRI performed September 5, 2017, also showed stable intramedullary[7] hyperintensity present from T1-2 to C7. Pet. Ex. 18 at 11.

On November 28, 2017, petitioner saw a second neurologist, Dr. Maria J. Servioli Verde. Dr. Verde noted that in December 2012, petitioner "started to experience numbness, tingling, and pain at the level of the left axillary region and shoulder, and pectoral area." Pet. Ex. 18 at 4. Petitioner reported that two months before his symptoms began, he received the flu vaccine. Id. Petitioner also indicated that eight years earlier, he had temporary loss of vision in his right eye, and over the last year, he had noticed progressive weakness of the left leg extremity such that he occasionally dragged the leg. Id. He stated that he had experienced leg weakness since his symptoms began, with waxing and waning of his leg symptoms. Id. Dr. Verde also noted that petitioner did not report pain in general, but that he did have residual paresthesias and pain in the left shoulder, along with occasional urinary incontinence.[8] Id. Physical examination revealed "[d]ecreased vibration and pinprick in the dorsal aspect of left foot" and erythrocyanosis of the left foot. Id. at 6. Petitioner was noted to "slightly drag the left leg." Id. Dr. Verde's diagnosis was TM and abnormal evoked potential[9] of the right eye. Id. at 7. Although Dr. Verde noted that petitioner reported receiving a flu shot two months before his symptoms began, Dr. Verde did not document this vaccination as a possible cause of petitioner's TM. Id.

D. Affidavits

In his initial affidavit, Mr. Pearson averred that he received a flu vaccine on October 18, 2012. Pet. Ex. 2 at ¶ 3. After receiving the vaccination, he states that he began experiencing pain in the upper left side of his chest and arm. Id. at ¶ 4. He was diagnosed with TM approximately one year later, on October 3, 2013. Id. at ¶ 5.

Petitioner executed a subsequent affidavit on October 9, 2017, in which he asserted that he "believe[s] the symptoms initially began in November 2012." Aff. dated Oct. 11, 2017 (ECF No. 33) at ¶ 2. He also recalled a "very specific episode" of pain in mid-December 2012. Id. at

[7] "Intramedullary" means "within the spinal cord." Dorland's Illustrated Medical Dictionary 954 (32d ed. 2012).

[8] Petitioner saw urologist Dr. Orville Jacobs on December 11, 2014, for an unrelated problem and denied any bladder or bowel concerns. Pet. Ex. 9 at 22.

[9] Evoked potential, in the visual context, means "changes in the evoked cortical potential when the eye is stimulated by light; variations are diagnostic for abnormalities of the visual system and for other disorders, particularly neurological disorders such as multiple sclerosis, that have visual symptoms." Dorland's at 1505.

¶ 3. Petitioner stated, however, that he "[did] not know the exact date of the onset of the symptoms." Id. at ¶ 2.

IV. Transverse Myelitis

Transverse myelitis is a rare disease "in which inflammation of the spinal cord results in neurological deficits, manifesting as weakness, sensory loss and autonomic dysfunction." Resp. Ex. C, Tab 3 (Borchers 2012) at 1. The etiology is thought to be multi-factorial and due to a combination of "genetic, immunological, hormonal and environmental factors." Pet. Ex. 23, Ref. 1 (Agmon-Levin 2009) at 2. "[U]p to 40% of TM cases are associated with a preceding infectious illness, mostly within a month of TM onset." Id. The cause of acute TM is generally not identified, and thus, the cause is referred to as idiopathic. Resp. Ex. C, Tab 3 (Borchers 2012) at 2.

When TM is coupled with demyelination of the optic nerve, it is referred to as neuromyelitis optica ("NMO"). Pet. Ex. 23, Ref. 1 (Agmon-Levin 2009) at 2. TM and NMO are "part of a spectrum of inflammatory demyelinating disorders, which also includes acute disseminated encephalomyelitis ["ADEM"] and MS." Resp. Ex. C, Tab 3 (Borchers 2012) at 2. TM is usually monophasic but can be recurrent in up to 25% of cases. Id. NMO events can occur "months, years or even decades apart and . . . the disease takes a recurrent or relapsing/remitting course in > 80% of patients." Id.

TM is suspected when a patient has "acute or subacute motor, sensory, bladder, and/or bowel dysfunction with a presence of a sensory level." Resp. Ex. A at 5. Early symptoms generally include "sensory dysfunction, paresthesias or pain in the back, abdomen or the extremities, and an often ascending pattern of numbness or weakness of the legs, whereas the upper extremities are less frequently and generally less severely affected." Resp. Ex. C, Tab 3 (Borchers 2012) at 8. Symptoms progress over hours or days, "with a majority of patients reaching their maximum deficient within 7 days, although full evolution may take up to 21 days." Id. Two-thirds of patients lose their ability to walk, and almost all have urinary retention. Id. Outcome ranges from full recovery to death from respiratory failure. Id. Diagnostic testing may include cerebrospinal fluid ("CSF") analysis, which may reveal CSF pleocytosis, characteristic of spinal cord inflammation. Pet. Ex. 23, Ref. 1 (Agmon-Levin 2009) at 1. IgG index may be abnormally elevated. Id. Most importantly, MRI may reveal the presence of spinal cord lesions. Id.

V. EXPERT OPINIONS

A. Petitioner – Dr. James Dahlgren, M.D.

i. Qualifications

Dr. Dahlgren earned his B.A. from the University of California at Los Angeles, and his M.D. from the University of California at San Francisco. Pet. Ex. 22 at 1. After completing residencies at both Boston Veteran's Hospital in Boston and Cedars-Sinai Medical Center in Los Angeles, he served as a fellow in infectious diseases at UCLA Medical Center. Id. Dr. Dahlgren

has held several academic appointments, including Assistant Professor of Medicine at the UCLA School of Medicine from 1975-1977, and Assistant Clinical Professor of Medicine at the University of California at Los Angeles School of Medicine from 1977-2011. Id. at 2. His CV lists 39 publications that he has authored or co-authored, along with a number of abstracts and presentations. Id. at 3-9. Dr. Dahlgren is board certified in internal medicine. Id. at 1.

ii. Opinion

1. Althen Prong One

Dr. Dahlgren opined that the flu vaccine caused an autoimmune phenomenon that contributed to the development of petitioner's TM. Pet. Ex. 16 at 11. He suggested several potential mechanisms whereby vaccines can cause "altered immune function," including molecular mimicry; epitope spreading; polyclonal activation of B lymphocytes, causing enhanced production of cytokines; T cell mediated immune response to oligodendrocytes; and autoimmune/inflammatory syndrome induced by adjuvants ("ASIA"). Id. at 4-11. Dr. Dahlgren also opined that petitioner had a genetic susceptibility to autoimmune conditions because his father suffered from Guillain-Barre Syndrome ("GBS"). Id. at 11. Other than listing them in his expert report, Dr. Dahlgreen did not describe or develop the theories of epitope spreading, polyclonal activation of B lymphocytes, or T cell mediated immune response to oligodendrocytes. He focused principally on two theories: molecular mimicry and adjuvant-induced autoimmunity.

Dr. Dahlgren claimed that the adjuvants in vaccines cause an increase in cytokines and autoantibodies, which cause autoimmune diseases. Pet. Ex. 16 at 4-9. He stated that the flu vaccine contains the adjuvants squalene and aluminum, which lead to autoimmune diseases, adding that "[i]t is likely that [petitioner's] trivalent influenza vaccine contained squalene as an adjuvant." Id. at 5. Dr. Dahlgren asserted that animal models show that squalene "is a powerful inducer of cytokines" that cause autoimmunity. Id. at 5. He suggested that in a susceptible person, an adjuvant can trigger the immune system. Id. at 8.

Dr. Dahlgren maintained that in addition to inducing cytokines, adjuvants themselves can cause autoimmune or inflammatory conditions. Pet. Ex. 16 at 8. He cited a study by Khan, et al., for the proposition that aluminum adjuvant in the HPV vaccine can cause damage to neurons in the brain. Id. at 9; see generally Pet. Ex. 25, Ref. 30 (Khan 2013). In addition to squalene and aluminum, Dr. Dahlgren opined that other adjuvants, including silicon, mineral oil, guaiacol, and iodine gadital, can cause autoimmune disease. Pet. Ex. 16 at 9. Dr. Dahlgren cited Korn-Lubetzki, et al., in support of his theory that the adjuvants in the flu vaccine may play a role in the development of autoimmune disease. Id. at 4; see generally Pet. Ex. 23, Ref. 2 (Korn-Lubetzki 2011).[10] The Korn-Lubetzki study raised the question of whether adjuvants "might" play a role in development of TM, but did not study the issue or reach any conclusions. Pet. Ex. 23, Ref. 2 (Korn-Lubetzki 2011) at 2. Likewise, the Agmon-Levin study discussed interest in

[10] Petitioner did not proffer any evidence to show that the flu vaccine at issue contained any of these adjuvants.

the adjuvant mechanism of causation, but only suggested that adjuvants "might be responsible." Pet. Ex 23, Ref. 1 (Agmon-Levin 2009) at 5.

An additional causal theory proposed by Dr. Dahlgren is molecular mimicry, which he described as an "accidental failure to recognize" one's own "cell, tissue or protein," resulting in an attack on "normal and healthy tissue." Pet. Ex. 16 at 4. He asserted that the "antibodies that attack the myelin" are "known to occur from vaccinations." Id. at 11. Here, Dr. Dahlgren pointed to Agmon-Levin, a study which asserted that antigens and self-antigens are the most common mechanism by which infections trigger TM and hypothesized that "it is reasonable to assume" that vaccines induce autoimmunity in the same manner as "infectious antigens." Pet. Ex. 23, Ref. 1 (Agmon-Levin 2009) at 4; see also Pet. Ex. 16 at 2-3. The authors of this study did not explain the basis for this assumption. Dr. Dahlgren also cited a study by Sato, et al., which did not ultimately support the mechanism of molecular mimicry. See generally Pet. Ex. 23, Ref. 3 (Sato 2011). At the conclusion of the study, the authors stated, "we could not find any data directly suggesting molecular mimicry between the nervous tissue and influenza vaccines." Id. at 4.

Underlying both causal theories is Dr. Dahlgren's opinion that certain persons are susceptible to autoimmune illnesses due to their genetics. See Pet. Ex. 16 at 8. Dr. Dahlgren observed that petitioner's father had "an autoimmune illness of Guillain-Barre syndrome, which is compatible with a genetic susceptibility in this family." Id. at 11.

Dr. Dahlgren pointed to a number of case reports describing patients who developed TM following vaccination. Pet. Ex. 16 at 4-9. One of these, Agmon-Levin, summarizes 37 cases of TM associated with a host of different vaccines. See generally Pet. Ex. 23, Ref. 1 (Agmon-Levin 2009). However, of the 37 cases, only two were reported following the flu vaccine; these cases involved adults ages 42 and 70, with onset nine and seven days following vaccination, respectively. Id. at 3. The authors conclude that the "rarity of post-influenza-vaccination neurological complications reported in recent years makes it impossible to establish a definite causal relation." Id. at 4. Of note, the authors pointed out that adverse neurological events have declined since the introduction of the HA form of the vaccine,[11] prepared from human stock of the virus. Id. Moreover, some of the cases were associated with live virus vaccines, unlike the influenza vaccine, which is an "inactivated or killed viral vaccine." Id.

2. Althen Prong Two

Regarding Prong Two, Dr. Dahlgren made the following conclusory statement: "The logical sequence is [petitioner] developed a well-known but rare complication from a influenza vaccine. There is no other risk factor for his illness." Pet. Ex. 16 at 11. In his second report, Dr. Dahlgren provided some context. He opined that the symptoms that began in petitioner's left axillary region and shoulder, reported to his doctor on January 4, 2013, were the first manifestations of his TM. Pet. Ex. 17 at 2. Dr. Dahlgren did not reference any facts or evidence

[11] Hemagglutinin, also known as HA, is "an agglutinin, e.g., an antibody or lectin, that agglutinates erythrocytes." Dorland's at 830.

from petitioner's clinical course or medical records that support his causal theories of vaccine causation based on either molecular mimicry or adjuvant-induced TM.

3. Althen Prong Three

Dr. Dahlgren opined that a temporal association of three months from vaccine to onset is appropriate. Pet. Ex. 16 at 11. He cited the table of cases from the Agmon-Levin study for the proposition that onset of TM can range from two days, to three months, to nine years in cases of oral polio vaccine. Id. at 3. However, he did not address the fact that the two cases of TM following flu vaccine occurred within nine days of vaccination, not three months. Dr. Dahlgren did not provide any literature or other foundational support for his opinion that three months is an appropriate temporal association for his proposed causal theories.

B. Dr. Scott Lipson, M.D.

i. Qualifications

Dr. Lipson received a B.A. from Harvard University and an M.D. from New York University School of Medicine. Pet. Ex. 20 at 1. He completed his residency at Harvard University's Beth Israel Deaconess Medical Center, followed by a fellowship in Clinical Neurophysiology at the University of Illinois Medical Center at Chicago. Id. Dr. Lipson is board certified in general neurology and clinical neurophysiology, and he currently practices at Neurology Consultants/EMG Centers of Chicagoland. Id. He has also co-authored three publications. Id. at 2.

ii. Opinion

Petitioner submitted two reports by Dr. Lipson. See Pet. Exs. 19, 21. In both reports, Dr. Lipson framed his opinions relative to those of Dr. Vartanian, respondent's expert neurologist, whose opinions are discussed below. Dr. Lipson did not offer a causal theory or mechanism whereby the flu vaccine can cause TM. He did not offer a logical sequence of cause and effect or otherwise opine that petitioner's flu vaccine caused TM. He did, however, opine regarding onset.

Dr. Lipson provided the following narrative of petitioner's clinical history:

> Mr. Pearson received an influenza vaccination of October 18, 2012 (as well as on three other occasions: October 18, 2011; September 26, 2013; and November 6, 2014). He reported symptoms of left axillary/shoulder/chest pain to Dr. David Dennis on January 4, 2013 (History provided to neurologist, Dr. Maria J. Servioli Verde, on August 29, 2016 related a symptom onset in [December] 2012, not further specified). Initial diagnosis from Dr. Dennis is herpes zoster, either with or without a rash and he received treatment with acyclovir and oral methylprednisolone. MRI C-spine with and without contrast from September 27, 2013 showed abnormal T2 signal hyperintensity in the central/left cervical cord from C7-T1. Serum blood test workup included elevated ACE levels but was

> otherwise unremarkable. MRI of the brain and lumbar spine did not show any other significant findings. NMO/aquaporin-4 antibody testing was negative. CSF studies showed mild protein elevation but were otherwise unremarkable as well. Mr. Pearson's clinical presentation is consistent with transverse myelitis.

Pet. Ex. 19 at 1. Although Dr. Lipson opined that petitioner's clinical course was consistent with TM, as stated above, he did not opine that the flu vaccine caused petitioner's TM.

Dr. Lipson offered two opinions as to onset – one based on petitioner's initial symptoms, and the other based upon the MRI performed in September 2013. In his initial report, he opined that the onset of petitioner's TM occurred 10-11 weeks after his flu vaccine. Pet. Ex. 19 at 2. Dr. Lipson stated:

> The first manifestation of [petitioner's TM] consist of his left shoulder/axilla and chest pain, corresponding to the C7-T1 spinal level affected. The first date for which he sought medical attention for those symptoms is January 4, 2013 with Dr. Dennis, nearly 11 weeks after the influenza vaccination of October 18, 2012. The only other reference in the medical record as to symptom onset occurs several years after the fact during his visit with Dr. Maria J. Servioli Verde on August 29, 2016 (". . . 2 months before his symptoms started in 10/2012, he received the flu vaccine").
>
> Dr. Dennis does not specify in his evaluation of January 4, 2013 how long [petitioner] had experienced his shoulder/axillary pain. . . . To a reasonable degree of medical certainty, therefore, the date of onset occurred in the first days of January 2013. One can therefore place the onset of [TM] 10-11 weeks after the influenza vaccination."

Id. Dr. Lipson also provided a second opinion as to onset, in agreement with Dr. Vartanian's interpretation of petitioner's September 26, 2013 MRI. Dr. Lipson reviewed the interpretation of petitioner's MRI, as well as screenshots of the images themselves, and expressly agreed with Dr. Vartanian's position that onset occurred within 1-2 months of the MRI. Pet. Ex. 21 at 2. This interpretation places onset of petitioner's TM in July or August 2013, nine or more months after his flu vaccination.

While Dr. Lipson opined in his first report that petitioner's clinical presentation was consistent with TM, it was not clear whether Dr. Lipson's opinion referred to petitioner's initial presentation in January 2013, or his ultimate diagnosis of TM in October 2013. See Pet. Ex. 19 at 1. In his supplemental report, Dr. Lipson resolved this uncertainty when he opined that petitioner's initial presentation in January 2013 was "most consistent" with shingles "based on the dermatomal restriction, character of the pain and presence of pruritis." Pet. Ex. 21 at 1.

C. Dr. Timothy Vartanian, M.D., Ph.D.

i. Qualifications

Dr. Vartanian earned his B.A. from Oakland University, and both his Ph.D. and M.D. from the University of Chicago. Resp. Ex. B. at 2. After completing a neurology residency at Massachusetts General Hospital, he completed fellowships in Boston at Beth Israel Hospital and Harvard Medical School. Id. at 3. Dr. Vartanian has taught courses at Harvard Medical School on topics such as CNS myelination. Id. at 3, 5. He has co-authored 56 studies, and he serves as an ad hoc reviewer for a number of publications, including the New England Journal of Medicine, the Journal of Neuroscience Research, and the Journal of Comparative Neurology. Id. at 13-20.

Currently, Dr. Vartanian serves as a professor of Neurology and Neuroscience at Weill Cornell Medical College, and he practices at the Judith Jaffe Multiple Sclerosis Center. Resp. Ex. A at 1; Resp. Ex. B at 4. He is board certified in adult neurology. Resp. Ex. B. at 4.

ii. Opinion

1. Althen Prong One

Dr. Vartanian disagreed with Dr. Dahlgren that any evidence supported a causal association between the flu vaccine and TM. Resp. Ex. A at 5. He explained that it is "generally agreed in the scientific community that we cannot determine causality through individual case reports," citing a study by Rasmussen, et al., for this general proposition. Id. at 7; see generally Resp. Ex. A, Tab 1 (Rasmussen 2012). Dr. Vartanian noted that approximately 1,400 new cases of TM are diagnosed each year. Resp. Ex. A at 6 (citing Transverse Myelitis Fact Sheet, Nat'l Inst. of Neurological Disorders & Stroke, http://www.ninds.nih.gov/disorders/transversemyelitis/detail_transversemyelitis.htm (last visited June 18, 2019)). He further observed that the Agmon-Levin study cited by petitioner summarized cases reported in the literature over a period of 39 years. Id. Assuming 1,400 cases of TM were diagnosed per year, one would expect approximately 54,600 new cases of TM over the time period covered by Agmon-Levin. Id. Yet, out of thousands of newly diagnoses cases, Agmon-Levin only associated two TM cases with flu vaccines. See id. Additionally, Dr. Vartanian noted, the authors did not provide any statistical analysis to "discern the probability of chance occurrence versus causal occurrence." Id. at 7.

Dr. Vartanian also disagreed that adjuvants in vaccines can cause TM. He explained that the articles cited by Dr. Dahlgren in support of this theory are not relevant because they have "no temporal, physiologic, or pathologic similarities to [petitioner's] case." Resp. Ex. A at 7. For example, in the Lujan study, sheep were given vaccines against ovine pathogens that contained the adjuvants aluminum and thimerosal. See Pet. Ex. 25, Ref. 29 (Lujan 2013). However, as Dr. Vartanian emphasized, "the lambs received a total of 14 inoculations" over 9 months, and thus "[t]he adjuvant exposure in these lambs was significantly higher than that of [petitioner]." Resp. Ex. A at 8. Moreover, in the sheep study, subsequent pathology slides revealed histopathological lesions not relevant to this case. Id.

With regard to petitioner's theory that the flu vaccine can cause TM through the mechanism of molecular mimicry, Dr. Vartanian responded that the autoantibodies that cause TM "are not known." Resp. Ex. A at 6. In support of his conclusion, he cited a study by Borchers, et al. Id.; see also Resp. Ex. C, Tab 3 (Borchers 2012). This study discussed possible mechanisms whereby activation of an autoimmune response may cause TM, stating that molecular mimicry has "long been thought to play a primary role in triggering a variety of autoimmune diseases. However, evidence has remained elusive in most cases, with the possible exception of [GBS]." Resp. Ex. C, Tab 3 (Borchers 2012) at 12. The authors reviewed current findings and noted growing evidence that antibodies targeting the aquaporin-4 water channel of the central nervous system may play a pathogenic role in NMO and TM. Id. at 1.

Dr. Vartanian also contested Dr. Dahlgren's claim that petitioner was genetically predisposed to TM. Dr. Vartanian rebutted this assertion by stating that there is "no epidemiologic evidence that individuals with a family history of GBS are more likely to develop [TM]." Resp. Ex. A at 6.

2. Althen Prong Two

Dr. Vartanian opined that there was no logical sequence of cause and effect because petitioner's clinical presentation in January 2013 was "most consistent" with shingles and not TM, "based on the dermatome restriction, character of the pain and presence of pruritis." Resp. Ex. C at 1. Noting that petitioner subsequently developed symptoms of numbness and leg weakness, Dr. Vartanian attributed petitioner's initial symptoms to varicella zoster.[12] Id. at 3. The evolution of petitioner's course was prolonged, and thus, atypical of acute TM, which usually progresses from onset of symptoms to maximum deficit within 72 hours. Id. at 5. Thus, Dr. Vartanian concluded, petitioner's symptoms were more consistent with varicella zoster myelitis. Id. at 5.

3. Althen Prong Three

Dr. Vartanian observed that the symptoms that led to petitioner's TM diagnosis were first reported on January 4, 2013, approximately 11 weeks after vaccination. Resp. Ex. A at 10. He maintained that "11 weeks falls well outside generally accepted time frames for post-immunization induced pathology." Id. However, Dr. Vartanian also acknowledged that the difficulty in placing the onset of TM in January 2013 is that petitioner's clinical course was prolonged and atypical for TM. Resp. Ex. C at 3. He emphasized that while "[t]he clinical course of transverse myelitis from onset of symptoms to maximal deficit is 12-72 hours typically," petitioner did not reach maximal deficit until 12 months after onset. Id. at 5. Thus, Dr. Vartanian asserted in the alternative that petitioner's January 2013 symptoms were likely caused not by TM, but by varicella zoster. Id. at 1. Petitioner's varicella zoster reactivation, Dr. Vartanian explained, subsequently caused him to develop TM. Id. at 5. Based on petitioner's September 2013 MRI, which showed an increased T2 signal in the spinal cord from C7 to T1,

[12] Varicella zoster virus, or human herpesvirus 3, is the virus that causes chickenpox and shingles (herpes zoster). Dorland's at 853, 1703, 2017, 2024.

Dr. Vartanian opined that the onset of petitioner's TM was "within 1-2 months of the MRI." Id. at 12.

VI. DISCUSSION

A. Standards for Adjudication

The Vaccine Act was established to compensate vaccine-related injuries and deaths. § 10(a). "Congress designed the Vaccine Program to supplement the state law civil tort system as a simple, fair and expeditious means for compensating vaccine-related injured persons. The Program was established to award 'vaccine-injured persons quickly, easily, and with certainty and generosity.'" Rooks v. Sec'y of Health & Human Servs., 35 Fed. Cl. 1, 7 (1996) (quoting H.R. Rep. No. 908 at 3, reprinted in 1986 U.S.C.C.A.N. at 6287, 6344).

Petitioner's burden of proof is by a preponderance of the evidence. § 13(a)(1). The preponderance standard requires a petitioner to demonstrate that it is more likely than not that the vaccine at issue caused the injury. Moberly v. Sec'y of Health & Human Servs., 592 F.3d 1315, 1322 n.2 (Fed. Cir. 2010). In particular, petitioner must prove that that the vaccine was "not only [the] but-for cause of the injury but also a substantial factor in bringing about the injury." Id. at 1321 (quoting Shyface v. Sec'y of Health & Human Servs., 165 F.3d 1344, 1352-53 (Fed. Cir. 1999)); Pafford v. Sec'y of Health & Human Servs., 451 F.3d 1352, 1355 (Fed. Cir. 2006). A petitioner who satisfies this burden is entitled to compensation unless respondent can prove, by a preponderance of the evidence, that the vaccinee's injury is "due to factors unrelated to the administration of the vaccine." § 13(a)(1)(B).

B. Legal Framework

i. Statute of Limitations

The statute of limitations, or the time frame within which a vaccinee or their legal representative must file a claim, is outlined in § 16(a)(2) of the Vaccine Act:

> [I]f a vaccine-related injury occurred as a result of the administration of such vaccine, no petition may be filed for compensation under the Program for such injury after the expiration of 36 months after the date of the occurrence of the first symptom or manifestation of onset or of the significant aggravation of such injury.

§ 16(a)(2) (emphasis added). This time period runs from the manifestation of the first objectively cognizable symptom, whether or not that symptom is sufficient for diagnosis. Carson v. Sec'y of Health & Human Servs., 727 F.3d 1365, 1369 (Fed. Cir. 2013). Whether a petitioner knows the cause of his injury is not significant for purposes of the statute of limitations. Cloer v. Sec'y of Health & Human Servs., 654 F.3d 1322, 1330-35 (Fed. Cir. 2011) (en banc).

ii. Causation

To receive compensation under the Program, petitioner must prove either: (1) that he suffered a "Table Injury"—i.e., an injury listed on the Vaccine Injury Table—corresponding to a vaccine that he received, or (2) that he suffered an injury that was caused by a vaccination. See §§ 13(a)(1)(A) and 11(c)(1); Capizzano v. Sec'y of Health & Human Servs., 440 F.3d 1317, 1319-20 (Fed. Cir. 2006). Petitioner must show that the vaccine was "not only a but-for cause of the injury but also a substantial factor in bringing about the injury." Moberly, 592 F.3d at 1321 (quoting Shyface, 165 F.3d at 1352-53).

Because petitioner does not allege that he suffered a Table injury, he must prove that the vaccine caused his TM. To do so, he must establish, by preponderant evidence: (1) a medical theory causally connecting the vaccine and his injury ("Althen Prong One"); (2) a logical sequence of cause and effect showing that the vaccine was the reason for his injury ("Althen Prong Two"); and (3) a showing of a proximate temporal relationship between the vaccine and his injury ("Althen Prong Three"). § 13(a)(1); Althen v. Sec'y of Health & Human Servs., 418 F.3d 1274, 1278 (Fed. Cir. 2005).

The causation theory must relate to the injury alleged. Thus, petitioner must provide a reputable medical or scientific explanation that pertains specifically to this case, although the explanation need only be "legally probable, not medically or scientifically certain." Knudsen v. Sec'y of Health & Human Servs., 35 F.3d 543, 548-49 (Fed. Cir. 1994). Petitioner cannot establish entitlement to compensation based solely on assertions. Rather, a vaccine claim must be supported either by medical records or by the opinion of a medical doctor. § 13(a)(1). In determining whether petitioner is entitled to compensation, the special master shall consider all material contained in the record, including "any . . . conclusion, [or] medical judgment . . . which is contained in the record regarding . . . causation." § 13(b)(1)(A). The undersigned must weigh the submitted evidence and the testimony of the parties' offered experts and rule in petitioner's favor when the evidence weighs in his favor. See Moberly, 592 F.3d at 1325-26 ("Finders of fact are entitled—indeed, expected—to make determinations as to the reliability of the evidence presented to them and, if appropriate, as to the credibility of the persons presenting that evidence"); Althen, 418 F.3d at 1280 (noting that "close calls" are resolved in petitioner's favor).

iii. Evaluation of Expert Testimony

Another important aspect of the causation-in-fact case law under the Vaccine Act concerns the factors that a special master should consider in evaluating the reliability of expert testimony and other scientific evidence. In Daubert v. Merrell Dow Pharm., Inc., the Supreme Court listed certain factors that federal trial courts should utilize in evaluating proposed expert testimony concerning scientific issues. 509 U.S. 579 (1993). In Terran v. Sec'y of Health & Human Servs., the Federal Circuit ruled that it is appropriate for special masters to utilize the Daubert factors as a framework for evaluating the reliability of causation-in-fact theories presented in Program cases. 195 F.3d 1302, 1316 (Fed. Cir. 1999).

Daubert instructs fact-finders to consider (1) whether a theory or technique can be (and has been) tested; (2) whether the theory or technique has been subjected to peer review and

publication; (3) whether there is a known or potential rate of error and whether there are standards for controlling the error; and (4) whether the theory or technique enjoys general acceptance within a relevant scientific community." Terran, 195 F.3d at 1316 n.2 (citing Daubert, 509 U.S. at 592-95). In addition, where both sides offer expert testimony, a special master's decision may be "based on the credibility of the experts and the relative persuasiveness of their competing theories." Broekelschen v. Sec'y of Health & Human Servs., 618 F.3d 1339, 1347 (Fed. Cir. 2010) (citing Lampe v. Sec'y of Health & Human Servs., 219 F.3d 1357, 1362 (Fed. Cir. 2000)). However, nothing requires the acceptance of an expert's conclusion "connected to existing data only by the ipse dixit of the expert," especially if "there is simply too great an analytical gap between the data and the opinion proffered." Snyder v. Sec'y of Health & Human Servs., 88 Fed. Cl. 706, 743 (2009) (quoting Gen. Elec. Co. v. Joiner, 522 U.S. 146 (1997)).

A treating physician's opinions are considered "quite probative," as treating physicians are in the "best position" to evaluate the vaccinee's condition. Capizzano, 440 F.3d at 1326. However, no treating physician's views bind the special master, per se; rather, their views should be carefully considered and evaluated. § 13(b)(1); Snyder, 88 Fed. Cl. at 745 n.67. Each opinion from a treating physician should be weighed against other, contrary evidence present in the record – including conflicting opinions from other treating physicians. Hibbard v. Sec'y of Health & Human Servs., 100 Fed. Cl. 742, 749 (Fed. Cl. 2011), aff'd, 698 F.3d 1355 (Fed. Cir. 2012); Caves v. Sec'y of Health & Human Servs., 100 Fed. Cl. 119, 136 (Fed. Cl. 2011), aff'd, 463 F. App'x 932 (Fed. Cir. 2012); Veryzer v. Sec'y of Health & Human Servs., No. 06-522V, 2011 WL 1935813, at *17 (Fed. Cl. Spec. Mstr. Apr. 29, 2011), aff'd, 100 Fed. Cl. 344 (2011).

iv. Diagnosis

The Federal Circuit has made clear that "identifying [the petitioner's] injury is a prerequisite" to the Althen analysis. Broekelschen v. Sec'y of Health & Human Servs., 618 F.3d 1339, 1346 (Fed. Cir. 2010). However, it is not necessary to diagnose an exact condition. The Federal Circuit has explained: "The function of a special master is not to 'diagnose' vaccine-related injuries, but instead to determine 'based on the record evidence as a whole and the totality of the case, whether it has been shown by a preponderance of the evidence that a vaccine caused the petitioner's injury.'" Lombardi v. Sec'y of Health & Human Servs., 656 F.3d 1343, 1351 (Fed. Cir. 2011) (citing Andreu v. Sec'y of Health & Human Servs., 569 F.3d 1367, 1382 (Fed. Cir. 2009)).

C. Analysis

i. Althen Prong One: Petitioner's Medical Theory

Under Althen Prong One, petitioner must set forth a medical theory explaining how his flu vaccine could have caused his TM. Andreu v. Sec'y of Health & Human Servs., 569 F.3d 1367, 1375 (Fed. Cir. 2009); Pafford, 451 F.3d at 1355-56. Petitioner's theory of causation must be informed by a "sound and reliable medical or scientific explanation." Knudsen, 35 F.3d at 548; see also Veryzer v. Sec'y of Health & Human Servs., 98 Fed. Cl. 214, 223 (2011) (noting that special masters are bound by both § 13(b)(1) and Vaccine Rule 8(b)(1) to consider only

evidence that is both "relevant" and "reliable"). If petitioner relies upon a medical opinion to support his theory, the basis for the opinion and the reliability of that basis must be considered in the determination of how much weight to afford the offered opinion. See Broekelschen, 618 F.3d at 1347 (Fed. Cir. 2010) ("The special master's decision often times is based on the credibility of the experts and the relative persuasiveness of their competing theories."); Perreira v. Sec'y of Health & Human Servs., 33 F.3d 1375, 1377 n.6 (Fed. Cir. 1994) (stating that an "expert opinion is no better than the soundness of the reasons supporting it") (citing Fehrs v. United States, 620 F.2d 255, 265 (Ct. Cl. 1980)).

Petitioner's theory of causation, as outlined in Dr. Dahlgren's first expert report, relies on several faulty premises. Pet. Ex. 16 at 11. The undersigned will consider each in turn.

Molecular Mimicry and Adjuvants

Dr. Dahlgren asserted that "human and animal studies show[] that vaccine and adjuvants excite a large increase in cytokines and . . . autoantibodies, resulting in autoimmune disease." Pet. Ex. 16 at 11. Although he proposed several mechanisms that might provoke this result, he focused on molecular mimicry and ASIA. Neither mechanism satisfies the demands of Althen Prong One.

Molecular mimicry points to "the ability of viral or bacterial antigens to induce cross-reactive immune responses against self antigens." Resp. Ex. C, Tab 3 (Borchers 2012) at 11. But while this mechanism "has long been thought to play a primary role in triggering a variety of autoimmune diseases . . . evidence has remained elusive in most cases, with the possible exception of [GBS]." Id. at 12. Other studies have clarified that "present data tend to exclude a causal mechanistic role for molecular mimicry in the genesis of autoimmunity." Resp. Ex. C, Tab 15 (Trost 2010) at 3. Afterall, "it is difficult to reconcile the enormous number of viral and bacterial peptides disseminated throughout the human proteins with a fundamental role for molecular mimicry in the etiology of certain autoimmune conditions." Id.

Likewise, the undersigned finds that petitioner has not established a sufficient link between ASIA and the flu vaccine. Ever since Dr. Yehuda Shoenfeld and his colleagues coined the term in 2011, ASIA has intrigued many researchers. See Pet. Ex. 25, Ref. 24 (Shoenfeld 2011). However, that research has not provided a "sound and reliable" mechanism that might link TM to the flu vaccine. For instance, one study submitted by petitioner examined post-vaccination adverse events "of potential autoimmune origin" and found "no significant difference between MF59-adjuvanted and non-adjuvanted influenza vaccines." Pet. Ex. 25, Ref. 22 (Pellegrini 2009) at 5. On the subject of adjuvants, Dr. Vartanian provided a particularly effective rebuttal of petitioner's medical literature. The provided ASIA studies, he notes, "bear no temporal, physiologic, or pathologic similarities to [petitioner's] case." Resp. Ex. A at 7. In the Lujan study, for instance, lambs received a total of 14 vaccines in less than one year, exposing them to a significantly higher level of adjuvants than petitioner and producing strikingly different symptoms. Pet. Ex. 25, Ref. 29 (Lujan 2013); see also Resp. Ex. A at 8. The Poddighe case report is similarly inapplicable. There, the patient received the HPV vaccine, rather than the flu vaccine. Pet. Ex. 25, Ref. 28 (Poddighe 2014). Moreover, while that patient seemed to suffer from a somatoform illness that "could be interpreted as a case of ASIA," her

treating physicians ultimately concluded that "a diagnosis of any definite organic or immune-mediated disease could not be made." Id. at 5; see also Resp. Ex. A at 9.

Case Reports

Dr. Dahlgren relied on "multiple cases reported in the literature of patient's developing TM and other autoimmune diseases including many different vaccines, including influenza vaccine." Pet. Ex. 16 at 11. As a preliminary matter, the undersigned acknowledges that "[c]ase reports generally carry limited weight on the issue of causation," in part because they "lack controls and thus do not provide the level of information or detail found in epidemiologic studies." Bast v. Sec'y of Health & Human Servs., No. 01-565V, 2012 WL 6858040, at *38 n.104 (Fed. Cl. Spec. Mstr. Dec. 20, 2012), appeal dismissed sub nom. M.S.B. ex rel. Bast v. Sec'y of Health & Human Servs., 579 F. App'x 1001 (Fed. Cir. 2014). Respondent, conversely, has provided literature that answers these reports with much more thorough analysis of the alleged relationship between vaccines and demyelinating diseases. See, e.g., Resp. Ex. C, Tab 3 (Borchers 2012) at 12 (discussed above); Resp. Ex. C, Tab 3 at 5 (concluding that "[v]accination does not appear to increase the short-term risk of relapse in multiple sclerosis"); Resp. Ex. C, Tab 19 (IOM 2012) at 5 (concluding that "the mechanistic evidence regarding an association between influenza vaccine and onset of MS in adults [is] lacking").[13]

Likewise, petitioner's heavy reliance on the Agmon-Levin paper provides little support for his theory. This study provided a comprehensive survey of 39 years of TM cases, yet it uncovered only two cases that could be hypothetically linked to a flu vaccine. Pet. Ex. 23, Ref. 1 (Agmon-Levin 2009); see also Resp. Ex. A at 6 (estimating that "[o]ver the 39-year period that [Agmon-Levin] covered, the cumulative number of [TM] cases would be an estimated 54,600"). Moreover, as Dr. Vartanian pointed out, the data set examined by the study includes a number of complex variables: "incidence of [TM], the frequency of each of the relevant vaccines, time from vaccination to symptoms, the presence or absence of infection clinically, . . . the presence or absence of infection documented by acute and convalescent titers . . . for relevant organisms, and seasonable variation." Resp. Ex. A at 7. The fact that the authors "provide no statistical analysis to discern the probability of chance occurrence versus causal occurrence" severely limits the study's relevance to our Althen inquiry. See id.

[13] The undersigned also notes that when post-vaccination demyelinating diseases are discussed in the literature, they are often associated with vaccines other than the flu vaccine. See, e.g., Pet. Ex. 23, Ref. 10 (Holt 1976) (diffuse myelitis reported following rubella vaccination); Pet. Ex. 24, Ref. 11 (Trevisani) (TM following Hepatitis B vaccination); Pet. Ex. 24, Ref. 12 (Joyce 1995) (TM following measles, mumps, and rubella vaccination); Pet. Ex. 24, Ref. 13 (Matsui 2002) (TM following Japanese B encephalitis vaccination); Pet. Ex. 24, Ref. 14 (Das 2007) (TM following typhoid vaccination); Pet. Ex. 24, Ref. 15 (Read 1992) (TM following tetanus toxoid vaccination). She emphasizes, however, that "without any empirical evidence that the theory actually applies to the influenza vaccine and TM, the first prong of Althen would be rendered meaningless." Caves v. Sec'y of Health & Human Servs., 100 Fed. Cl. 119, 135 (2011), aff'd without opinion, 463 F. App'x 932 (Fed. Cir. 2012).

Genetic Susceptibility

Dr. Dahlgren maintained that "some people have a susceptibility to develop an autoimmune response to a vaccine," and that petitioner's family history indicates such a "genetic susceptibility."[14] Pet. Ex. 16 at 11. The parties' medical literature suggests that this could be true. See Pet. Ex. 25, Ref. 27 (Tomljenovic 2014) at 2 ("[T]he importance of genetic background in autoimmune diseases is well documented."); Resp. Ex. C, Tab 3 (Borchers 2012) at 11 (correlating NMO with a family history of autoimmune disease). However, this alleged susceptibility only supports petitioner's causal mechanism if "[t]here is no other risk factor for his illness," as Dr. Dahlgren opined. See Pet. Ex. 16 at 11. As the undersigned will explain below, another risk factor unrelated to the vaccination was very likely at play.

ii. Althen Prong Two: Logical Sequence of Cause and Effect

Under Althen Prong Two, petitioners must prove by a preponderance of the evidence that there is a "logical sequence of cause and effect showing that the vaccination was the reason for the injury." Capizzano, 440 F.3d at 1324 (quoting Althen, 418 F.3d at 1278). "Petitioner must show that the vaccine was the 'but for' cause of the harm . . . or in other words, that the vaccine was the 'reason for the injury.'" Pafford, 451 F.3d at 1356 (internal citations omitted).

Even assuming that the flu vaccine could cause TM, the undersigned finds that it did not do so in this case. As Dr. Vartanian observed, the "prolonged progression of the clinical course" seen in petitioner's case "is atypical for [TM]." Resp. Ex. C at 3. Although petitioner claims an onset of December 31, 2012, his symptoms continued to worsen over an extended period of time, and he was not diagnosed with TM until October 3, 2013. "This would suggest clinical progression over months or even a year, which is exceedingly unusual." Id. In contrast, most TM sufferers advance from onset of symptoms to maximum deficit within weeks, days, or even hours. Id.; see also Resp. Ex. C, Tab 2 (Berman 1981) at 3 (observing intervals between earliest symptoms and maximum deficit of 2 hours to 14 days); Resp. Ex. C, Tab 3 (Borchers 2012) at 8 (observing intervals between earliest symptoms and maximum deficit of 1 to 21 days); Resp. Ex. C, Tab 6 (Christensen 1990) at 6 (observing intervals between earliest symptoms and maximum deficit of 1 hour to 20 days). Petitioner's September 2013 MRI results cast further doubt on his proposed sequence of cause and effect. Based on the radiologist's interpretation of the images, Dr. Vartanian opined (and Dr. Lipson agreed) that "the onset of the TM is probably within 1-2 months of the MRI." Resp. Ex. C at 12.

Petitioner's ultimate diagnosis of TM has never been disputed, but his initial diagnosis is a more complex question. Although Dr. Dennis may have eventually abandoned his opinion that petitioner suffered from varicella zoster (or herpes zoster) in January 2013, Dr. Vartanian argued persuasively that this diagnosis was correct all along. Varicella zoster reactivation is a relatively common ailment – approximately 1 million new cases are diagnosed annually in the United States, and 90% of these patients are immunocompetent. Resp. Ex. D, Tab 1 (Gilden 2014) at 3-

[14] The undersigned notes that Dr. Vartanian disagreed. See Resp. Ex. A at 6 ("There is no epidemiologic evidence that individuals with a family history of GBS are more likely to develop transverse myelitis.").

4. Indeed, petitioner's initial left arm and chest pain is characteristic of post-herpetic neuralgia, "the most common neurologic complication of zoster." Id. at 6; Resp. Ex. C at 4-5. Moreover, varicella zoster myelitis is a known complication of varicella zoster reactivation, which "[i]mportantly . . . may develop without rash." Resp. Ex. D, Tab 1 (Gilden 2014) at 8; see also Resp. Ex. C at 2 (noting that "Herpes Zoster sine herpete can cause focal myelitis at the relevant segmental levels"). And as Dr. Vartanian observed, the fact that petitioner's January 2013 symptoms were "treated early and appropriately with high dose anti-viral agents" would have "reduce[d] the likelihood of lesion formation." Resp. Ex. C at 2. Naturally, the fact that Dr. Lipson concurred with Dr. Vartanian's opinion gives it additional weight. See Pet. Ex. 21 at 1.

The undersigned finds that petitioner's January 2013 symptoms indicated varicella zoster (shingles), not early signs of TM. This conclusion resolves any disparity between the typical progression of TM and the clinical course exhibited by petitioner. In reaching this conclusion, the undersigned does not determine the cause of petitioner's TM. While Dr. Vartanian opined that petitioner's clinical course is typical of varicella zoster myelitis,[15] he also allowed that petitioner's TM may simply be idiopathic.[16] Resp. Ex. C at 2. But the undersigned does determine that whatever the cause of petitioner's TM, his October 2012 flu vaccination was not involved.

iii. Althen Prong Three: Proximate Temporal Relationship

Under Althen Prong Three, petitioner must provide "preponderant proof that the onset of symptoms occurred within a time frame for which, given the understanding of the disorder's etiology, it is medically acceptable to infer causation-in-fact." De Bazan, 539 F.3d at 1352. The acceptable temporal association will vary according to the medical theory advanced in the case. See Pafford, 451 F.3d at 1358. A temporal relationship between a vaccine and an injury, standing alone, does not constitute preponderant evidence of vaccine causation. See, e.g., Veryzer v. Sec'y of Health & Human Servs., 100 Fed. Cl. 344, 356 (2011) (explaining that "a temporal relationship alone will not demonstrate the requisite causal link and that petitioner must posit a medical theory causally connecting the vaccine and injury").

Over the course of these proceedings, petitioner has asserted two different onset dates. Both dates are problematic. If petitioner's symptoms began on December 31, 2012, as he claims in his petition, onset would have occurred too late to be considered medically appropriate. If petitioner's symptoms arose in mid-November 2012, as he suggests in his affidavit, petitioner would run afoul of the statute of limitations.

---

[15] As Dr. Vartanian explains, "The diagnosis of [varicella zoster] mediated transverse myelitis, is confirmed by identification of the viral genome in CSF by . . . PCR and by the presence of anti-[varicella zoster] antibodies in the CSF." Resp. Ex. D at 1. Since petitioner did not undergo such testing, the diagnosis cannot be conclusively confirmed. See id.

[16] After all, "a significant fraction of all [TM] is not associated with an antecedent infection or illness and is thus technically idiopathic." Resp. Ex. C at 6.

1. December 31, 2012 Onset

Assuming an onset date of December 31, 2012, 74 days (10.6 weeks) elapsed between petitioner's vaccination and the first appearance of his symptoms. The medical literature filed by both parties weighs heavily against such a protracted onset period. Although many of petitioner's studies do not specifically address the flu vaccine or TM, those that do allege the following onset timeframes:

Study	Onset Period Following Flu Vaccination
Pet. Ex. 23, Ref. 1 (Agmon-Levin 2009)[17]	7 days; 9 days
Pet. Ex. 23, Ref. 2 (Korn-Lubetzki 2011)	1 month
Pet. Ex. 23, Ref. 3 (Sato 2011)	1 month
Pet. Ex. 23, Ref. 4 (Nakamura 2003)	7 days
Pet. Ex. 23, Ref. 5 (Bakshi 1996)	4 weeks
Pet. Ex. 23, Ref. 6 (Wells 1971)	2 days; 29 days

Such shorter onset timeframes are, as other special masters have observed, "wholly consistent with the recognized acute nature of TM." Bender v. Sec'y of Health & Human Servs., No. 11-693V, 2018 U.S. Claims LEXIS 903, at *91 (Fed. Cl. Spec. Mstr. July 2, 2018), mot. for review denied, 141 Fed. Cl. 262 (2019). Thus, petitioner's own literature reinforces the undersigned's conclusion that a 74-day onset period is medically and scientifically unacceptable. Moreover, when determining the appropriate onset for a post-vaccination demyelinating disease, the undersigned's fellow special masters have reached very similar conclusions. See, e.g., Bender, 2018 U.S. Claims LEXIS 903, at *89-95 (determining that 42 days was not a medically acceptable timeframe for TM following Hepatitis A or meningococcal vaccines); Taylor v. Sec'y of Health & Human Servs., No. 13-700V, 2018 U.S. Claims LEXIS 425, at *67 (Fed. Cl. Spec. Mstr. Mar. 9, 2018) (finding that the proposed onset timeframe of 11 weeks between flu vaccination and onset of a demyelinating disease was "entirely too long"). Petitioner has provided no evidence that would lead the undersigned to deviate from this paradigm.

2. Mid-November 2012 Onset

Petitioner filed his petition on January 4, 2016, claiming an onset date of December 31, 2012. Because the Court was closed on New Year's Eve, and did not reopen until January 4, petitioner appeared to have just barely complied with the Vaccine Act's 36-month statute of limitations. However, in his October 2017 affidavit, petitioner stated that he "believe[s] the symptoms initially began in November 2012," and that he "recall[s] a very specific episode in

[17] Dr. Dahlgren seemed to cite this study for the proposition that an onset of "even longer than three months in some cases" may be appropriate. See Pet. Ex. 17 at 3-4; Pet. Ex. 16 at 2-3. Critically, however, the cases with longer onset timeframes all involved vaccines other than the flu vaccine at issue here. See Pet. Ex. 17 at 4. The letter from Dr. Yehuda Shoenfeld, filed with petitioner's literature, suffers from the same flaw. While Dr. Shoenfeld claims that "the incubation time for induction of autoimmunity following vaccination can be more than 3 years," he does not appear to cite any literature or other support involving the flu vaccine. See Pet. Ex. 25, Ref. 25 (Schoenfeld 2012).

mid-December 2012." Aff. at ¶¶ 2-3. An onset date of November 2012, or even mid-December 2012, would make compliance impossible. Moreover, petitioner has not demonstrated the kind of extraordinary circumstances that would allow him to invoke equitable tolling.

VII. CONCLUSION

TM has caused significant distress in petitioner's life over the past few years, and the undersigned empathizes with his dedicated search for medical and scientific answers. However, for all the reasons discussed above, the undersigned finds that petitioner has not established by preponderant evidence that he is entitled to compensation and his petition must be dismissed. In the absence of a timely filed motion for review pursuant to Vaccine Rule 23, the Clerk of the Court **SHALL ENTER JUDGMENT** in accordance with this Decision.

IT IS SO ORDERED.

s/Nora Beth Dorsey
Nora Beth Dorsey
Chief Special Master